Salmonella and *Campylobacter* in broiler transport cages

Mark Berrang
USDA-Agricultural Research Service
Russell Research Center

FSIS Public Meeting 2/23/06

Pathogens and transport coops

- *Salmonella* has been detected in coops
- U. S. study: *Salmonella* found on 8/160 (5%) coops prior to use and on 16/160 (10%) coops after use Bailey et al., JFP 2002 64:1690-1697
- Belgian study: 56/128 (43.8%) crates positive prior to use Heyndrickx et al, E&I 2002 129:253-265
  - Showed prevalence of *Salmonella* + broilers increased due to transport…authors suggest that crates are important source
- Similar suggestions have been made relative to *Campylobacter*

Source of *Campylobacter* and *Salmonella*

- *Campylobacter* and *Salmonella* are present in the gut and feces of broilers from positive flocks
- Feed withdrawal prior to catching can result in change in bacterial profile of alimentary tract
- Stress associated with transport leads to higher rates of excretion which continues during holding
- The result is that *Campylobacter* and *Salmonella* can contaminate surfaces in transport coops

Coop flooring and carcass microbiology

Buhr et al 2000 PS 79:436-441

- Study compared broilers transported on solid floors to those transported on elevated wire floors (less contact with feces)
- Feathered carcasses transported on solid flooring had noticeably more fecal contamination…higher numbers of *E. coli*
- However, after defeathering all differences in broiler carcass microbiology disappeared

Cross contamination

Berrang et al, 2003 JAPR 12:190-195

- A study was conducted to examine the possibility that contaminated feces left in a dump coop can cause transfer of *Campylobacter* to broilers that were previously free of Campy
- Fecal contamination was isolated as the only source of *Campylobacter* to the test broilers

Results

- After just 2 hr exposure to contaminated feces, more than half the defeathered carcasses from test broilers (*Campylobacter* free flock) had become positive for *Campylobacter*
- Numbers on test carcasses were lower than on positive control carcasses (*Campylobacter* positive flock), but still substantial

Conclusions

- *Campylobacter* can be spread to previously negative broilers by contact with contaminated feces remaining in a dump coop
- Such contamination can remain on the carcass through scalding and picking.
- Similar findings have been reported with *Salmonella* Rigby et al, 1982 Can J Comp Med 46:272-278

Is washing and sanitizing the answer?

- About 28 % of US broiler plants have a coop wash or sanitize procedure in use
  Northcutt and Jones 2004 JAPR 13:48-54
- A higher percentage of processors in the EU wash/sanitize crates
- Nevertheless, European studies report detection of *Salmonella* and *Campylobacter* on crates even after washing and sanitizing
  Slader et al 2002 AEM 68:713-719; Corry et al 2002 JAM 92:424-432

Washing and sanitizing studies

- Reports exist in the literature that show some experimental washing and sanitizing procedures can work
- Research needs to be evaluated carefully
  - How were the chemicals inactivated before culture? (are the target bacteria being inadvertently killed after sample collection?)
  - How realistic or commercially viable is the procedure?
  - How expensive or unwieldy is the equipment? (immersion tanks and high temperature application may be expensive)

Coop washing test at commercial processing plant

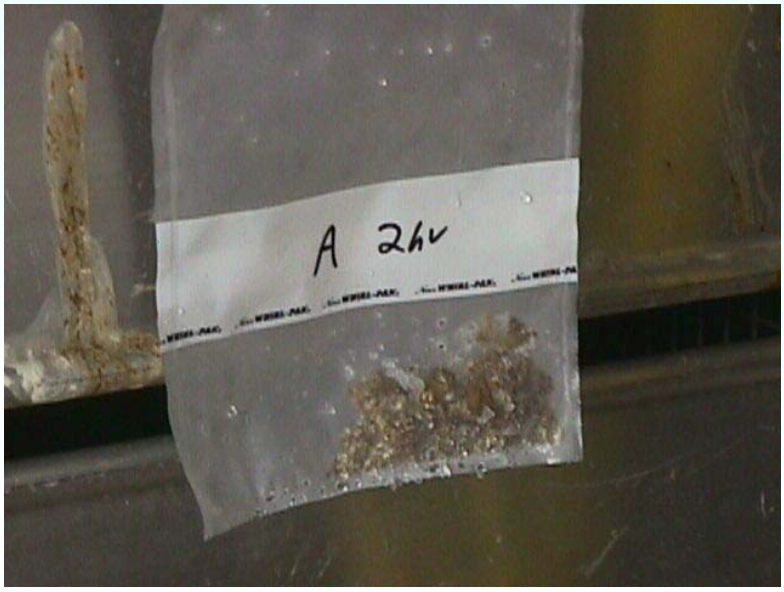
Northcutt and Berrang

- Measured numbers of total aerobic bacteria and E. coli as well as presence of *Salmonella* and *Campylobacter*
- Washing coops by spraying with water reduced numbers of aerobic bacteria and *E. coli*.
- Application of sanitizer lowered numbers more
- Prevalence of *Campylobacter* and *Salmonella* was lessened
- However, *Campylobacter* was still detected in 2/27 (7%) coop floor samples after washing and sanitizing

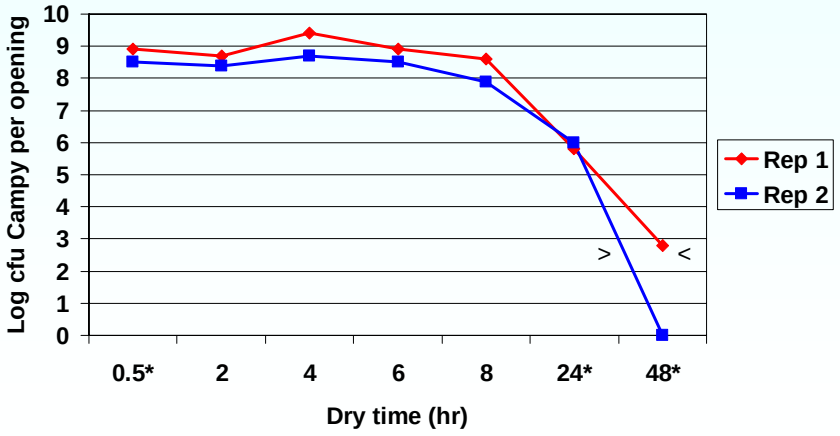
Novel approaches: Allowing coops to dry between uses

Berrang et al., 2004 PS 83:1213-1217

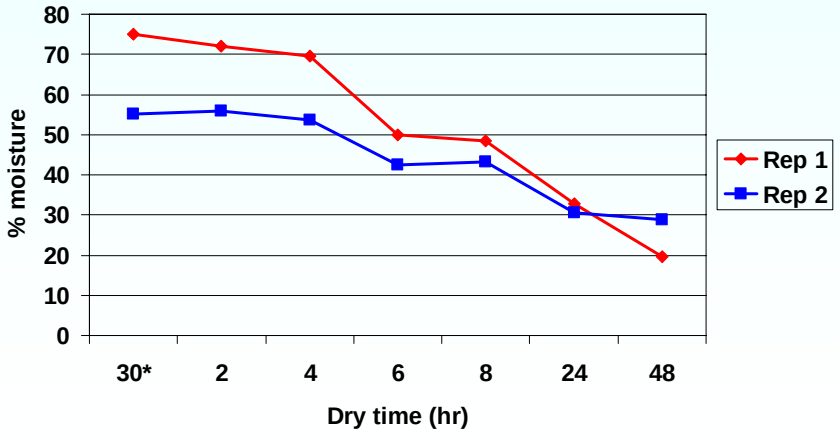
- Objective: determine the effect of storing dump coops between uses on the numbers of viable *Campylobacter* in feces that was deposited on the floor by *Campylobacter* positive broilers
- Hypothesis: allowing feces to dry out and remain exposed to atmospheric oxygen would lower the numbers of *Campylobacter* detected in feces



Mean Log_{10} *Campylobacter* detected per opening (all feces)



Percent moisture of feces collected from coop at time intervals



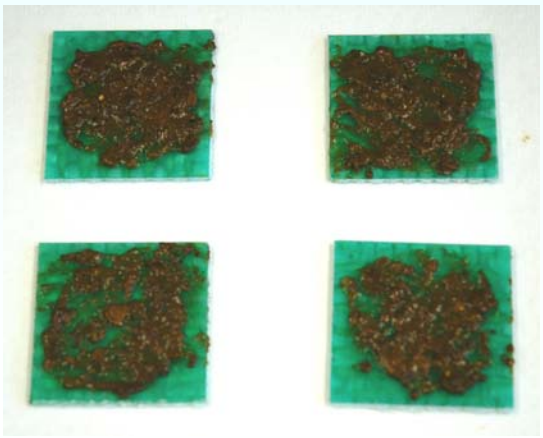
Conclusions

- Allowing transport coops to dry for 24–48h between uses results in lower numbers of *Campylobacter* remaining in the coops
- Such drying should not be counted on to eliminate *Campylobacter* entirely
- The expense required to maintain enough coops for extended dry times would be hard to justify

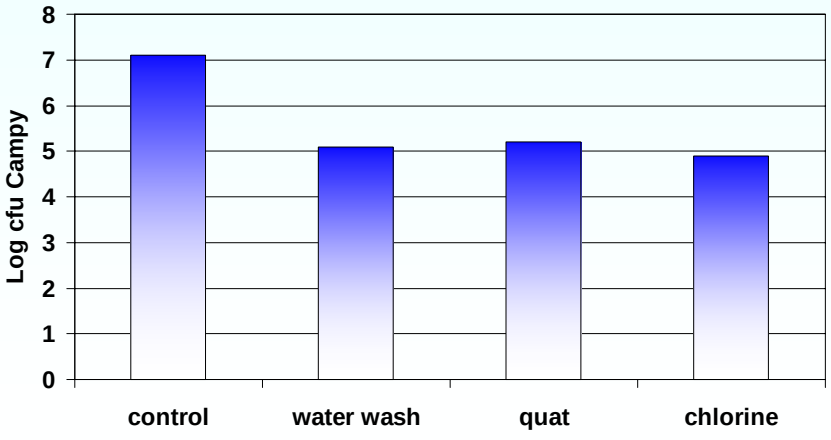
Washing and sanitizing coop flooring

Berrang and Northcutt, 2005 JAPR 14:315-321

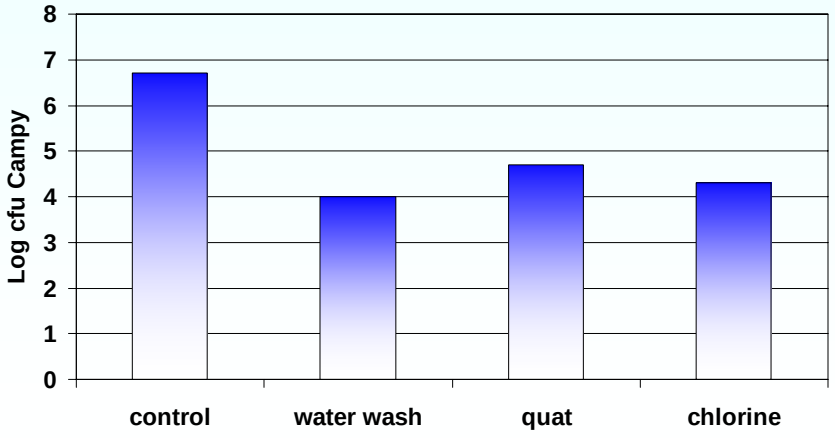
- Study designed to test the efficacy of spray washing and immersion in chemical sanitizers to eliminate *Campylobacter* on coop floor material.
- A more controlled study than the field study which tested washing and sanitizing under commercial conditions



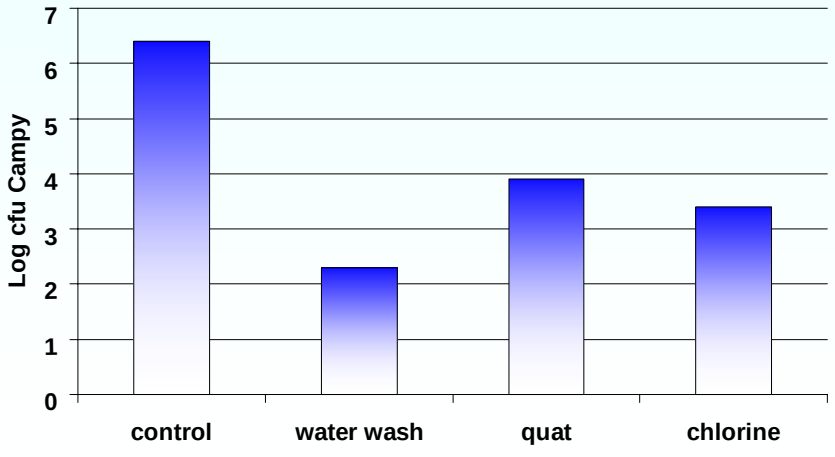
Water spray wash followed by 15 s immersion



Water spray wash followed by 60 s immersion



Water spray wash followed by 5 min. immersion



Summary and conclusions

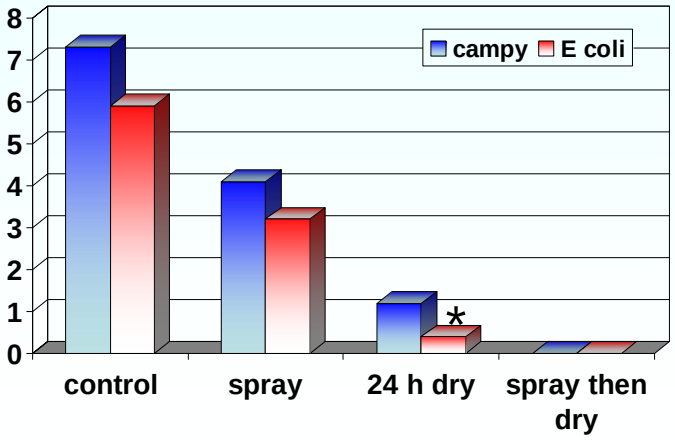
- Spraying the floor surface with tap water lowered the numbers of *Campylobacter* recovered.
- Adding an immersion in 200 ppm QAC or chlorine did not help
- The re-moistening effect may have actually revived Campy making recovery more likely

Water spray followed by drying as sanitizing step instead of chemical

Berrang and Northcutt, 2005 PS 84:1797-1801

- Measure effectiveness of water spray followed by an extended dry time to lower numbers of *Campylobacter* on soiled coop flooring
- Examine the effect of re-wetting on numbers of *Campylobacter* in gut contents previously allowed to dry on coop floor surface

Effect of water spray with and without subsequent drying time (log cfu/square)



* When rewet, *E. coli* numbers rebounded to 2.0

Water spray and drying

- Low pressure tap water spray lowered numbers of *Campylobacter* and *E. coli* on soiled coop flooring
- Simply allowing contaminated gut contents to dry out on the flooring had a greater effect on numbers of bacteria recovered
- Spray washing followed by drying was very effective in lowering bacterial numbers
- Re-moistening dried on gut contents caused an rebound in numbers of *E. coli* (*Salmonella*??) but not *Campylobacter*

Floor surface drying as a sanitation treatment?

- Allowing floor surface to thoroughly dry between uses could be part of an effective strategy to lower *Campylobacter* contamination in transport coops
- Would require a change in thinking relative to coop design and/or management
- Unsure how *Salmonella* would be affected, more research is required to determine role of VNC *Campylobacter* in treated coop

Overall

- Coop washing and sanitizing is an expensive proposition (water costs, personnel and time)
- Questionable efficacy
- New and innovative procedures may be more effective than traditional methods
- Ongoing research towards the goal of making coop washing practical, effective and affordable